

**SAMPLING AND ANALYSIS PLAN
FOR
GOLD KING MINE
SILVERTON, SAN JUAN COUNTY, COLORADO**

Prepared for
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 8

Prepared by
WESTON SOLUTIONS, INC.
Region 8 Superfund Technical Assessment and Response Team

September 5, 2014

For approval signatures, see Worksheet 1 & 2.

Project Dates of Sampling:	September 9-30, 2014
CERCLA ID / Site Spill Identifier No.:	NA/08UP
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List of Acronyms

AES	Atomic Emission Spectrometry
ARSG	Animas River Stakeholders Group
ASTM	American National Standards Institute
BLM	U.S. Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COR	Contracting Officer Representative
CRQL	Contract Required Quantitation Limits
CSM	Conceptual Site Model
DRMS	Division of Reclamation Mining and Safety
EDD	electronic data deliverable
EPA	United States Environmental Protection Agency
ERRS	Emergency and Rapid Response Services
ERT	Environmental Response Team
ESAT	Environmental Services Assistance Team
GIS	Geographic Information System
GPM	gallons per minute
HASP	Health and Safety Plan
ICP	inductively coupled plasma/mass spectrometry
L	liter
LLCCV	low level continuing calibration verification
MDL	method detection limit
mL/L	milliliters per liter
MS	matrix spike
MSD	matrix spike duplicate
NA	not applicable
NaOH	sodium hydroxide
PPE	personal protective equipment
PSI	pounds per square inch
PT	proficiency testing
PTL	Project Team Lead
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
START IV	Superfund Technical Assessment and Response Team 4
TAL	Target Analyte List
TBD	to-be-determined
TCL	target compound list
TDD	Technical Direction Document
µg/L	micrograms per liter
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
WAM	Work Assignment Manager
WESTON	Weston Solutions, Inc.
WQS	Water quality standard

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Introduction

This Sampling and Analysis Plan (SAP) identifies the data collection activities and associated quality assurance/quality control (QA/QC) measures specific to the Gold King Mine (the Site) located in Silverton, San Juan County, Colorado. All data will be generated in accordance with the quality requirements described in the Quality Assurance Project Plan (QAPP) for Region 8 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Removal and Emergency Response Activities in Colorado, Utah, Wyoming, Montana, North Dakota, and South Dakota (Weston 2013). The purpose of this SAP is to describe site-specific tasks that will be performed in support of the stated objectives. This SAP will reference the QAPP for generic tasks common to all data collection activities including routine procedures for sampling and analysis, sample documentation, equipment decontamination, sample handling, data management, assessment, and data review. Additional site-specific procedures and/or modifications to procedures described in the QAPP are described in the following SAP elements.

This SAP is prepared, reviewed, and approved in accordance with the procedures detailed in the QAPP. Any deviations or modifications to the approved SAP will be documented using Table 1: SAP Revision Form. This SAP is produced in accordance with the Unified Federal Policy (UFP) for QAPPs and consists of the site-specific UFP Worksheets from the QAPP.

Refer to the QAPP Worksheet 3 & 5, and 4, 7, & 8 for an organizational chart, communication pathways, personnel responsibilities and qualifications, and special personnel training requirements.

QAPP Reference

Weston Solutions, Inc. 2013. Quality Assurance Project Plan for Region 8 CERCLA Removal and Emergency Response Activities in Colorado, Utah, Wyoming, Montana, North Dakota, and South Dakota. Prepared for the START IV Contract. July 2013.

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Worksheet 1 & 2 — Title and Approval Page

(UFP-QAPP Manual Section 2.1)
(EPA 2106-G-05 Section 2.2.1)

1. Project Identifying Information

- a) **Site Name/Project Name:** Gold King Mine
- b) **Site Location/Number:** Silverton, San Juan County, Colorado
- c) **Contract/Work Assignment Number:** EP-S8-13-01/TDD 1408-01

2) List Plans and reports from previous investigation relevant to this project. Not Applicable

Lead Investigative Organization's SAP Author: Jan Christner/WESTON Senior Project Engineer
Printed Name/Title

Signature/Date

Lead Investigative Organization's Project Team Leader: Jan Christner/WESTON Senior Project Engineer
Printed Name/Title

Signature/Date

Lead Investigative Organization's Technical Manager: David Robinson/WESTON Response Coordinator
Printed Name/Title

Signature/Date

Federal Regulatory Agency OSC: Steven Way/OSC
Printed Name/Title

Signature/Date

Federal Regulatory Agency Delegated Approval Officer: _____
Printed Name/Title

Signature/Date

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Worksheet 9 — Project Planning Session Summary

(UFP-QAPP Manual Section 2.5.1 and Figures 9-12)
 (EPA 2106-G-05 Section 2.2.5)

Date of Planning Session: 8/19/2014				
Location: Phone call				
Purpose: Determine scope of Gold King work				
Name	Title/Role	Organization	Phone No.	E-mail Address
Steven Way	OSC	EPA	303-312-6723	Way.steven@epa.gov
Jan Christner	Senior Engineer/ PTL	WESTON	505-269-1925	Jan.chistner@westonsolutions.com

Notes/Comments: Phone calls to plan Gold King mine support.

Consensus Decisions Made:

- ☐ EPA's Emergency and Rapid Response Services (ERRs) contractor will provide a pump, water treatment supplies, and personnel to assist in water treatment setup
- ☐ WESTON will develop water treatment requirements, monitor the water treatment system and discharged water during mine entries, sample water as requested by the OSC, monitor air within the adit, and inspect portal construction, as requested by the OSC.
- ☐ WESTON will prepare a sampling plan, document site activities, and provide on-site technical support as needed during the mine entries and water treatment. WESTON will provide daily reports to the OSC and a final summary Site Activities Report.

Action Items:

Action	Responsible Party	Due Date
Develop SAP for sampling adit water and surface water associated with mine entries to be conducted the weeks of August 5 through 20	Jan Christner	September 5, 2014
Develop Health and Safety Plan	David Robinson	August 25, 2014
Provide site documentation, field monitoring, sampling, and analysis.	Jeff Bryniarski, Elliott Petri, Eric Sandusky	September 8-30, 2014
Prepare a Draft Site Activities Report	Jan Christner	October 30, 2014 If sample laboratory analysis is required, the report will be delayed until two months after the last sample is collected.
Prepare a Final Site Activities Report	Jan Christner	November 15, 2014 or 2 weeks after EPA comments are received, whichever is later.

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Worksheet 10 — Conceptual Site Model

(UFP-QAPP Manual Section 2.5.2)

(EPA 2106-G-05 Section 2.2.5)

- **Problem Definition**

The Gold King site consists of a mine adit and waste rock piles in the Cement Creek watershed. The mine discharges low pH, metals-laden water at a flow rate of approximately 100 gallons per minute (gpm). The water flows through a concrete channel, through a Parshall flume, through a plastic conduit, over a steep waste rock pile, and either into the subsurface (low flow), or toward North Fork Cement Creek. A pond has been constructed at the base of the waste rock pile to collect water during 2014 site activities. North Fork Cement Creek flows into Cement Creek, which discharges to the Animas River in Silverton, Colorado.

EPA's ERRS contractor will be opening the mine and stabilizing the portal and adit during September 2014 to facilitate future evaluation of the mine. Water at the nearby Red and Bonita Mine contains large amounts of particulates that are mobilized when personnel enter the mine. In order to prevent discharge of large amounts of particulates during the Gold King mine entries and portal/adit stabilization, water will be captured, treated, then released downstream of the site during mine entries and construction.

- **Background Information/Site History**

The Gold King Mine is in the Cement Creek watershed, which originates high in the rugged San Juan Mountains of southwestern Colorado near the San Juan County and Ouray County line on the south slopes of Red Mountain Number 3 and the north slopes of Storm Peak.

The rugged and relatively inaccessible western San Juan Mountains were first prospected in the area around Silverton in 1860. The extension of the railroad from Silverton up Cement Creek to Gladstone in 1899 encouraged the mining of low grade ores, and the establishment of a lead-zinc flotation plant in 1917 allowed for the treatment of the low grade complex ores found in the area. Over a 100-year period between 1890 and 1991, mining activities in the upper Animas River Basin, including Cement Creek, produced the waste rock and mill tailings sources from which contamination spread throughout the surface water pathway. Over 18 million tons of ore were mined from the Upper Animas River Basin area, with more than 95 percent of this being dumped directly into the Animas River and its tributaries in the form of mill waste. Older waste rock piles and stope fillings were reworked and sent to mills as technology allowed lower grade ores to be processed economically. A great deal of abandoned waste was also milled during World War II when many older mining and milling structures were cannibalized for scrap metal. The last producing mine in the area was the Sunnyside Mine, which ceased production in 1991. The closing of the Sunnyside mine occurred after Lake Emma drained into the mine and out the American Tunnel into Cement Creek in 1978. The flood water from the Lake Emma "blow-out" was reported to have flowed down Cement Creek in a 10-foot wall of water that would have transported a large quantity of tailing and other mine waste down Cement Creek to the Animas River.

Reclamation activities have been ongoing in the Cement Creek basin since 1991 when tailings were removed from the Lead Carbonate Mill site. Remediation work has also been conducted in Gladstone at the American Tunnel waste dump, Mayflower Mill, Gold King #7 Level Mine, Galena Queen, Hercules Mine, Henrietta Mine, and most recently at the Joe and

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John Mine and the Lark Mine in 2006 and 2007. No new reclamation activities have been initiated in 2008 or 2009.

Numerous historic and now abandoned mines exist within a two-mile radius of Gladstone. They include: the Upper Gold King 7 Level, American Tunnel, Grand Mogul, Mogul, and Red and Bonita, Evelyne, Henrietta, Joe and John, and Lark mines. Some of these mines have acid mine drainage that flows between 30 and 300 gpm directly or indirectly into Cement Creek and eventually into the Animas River, the confluence located about eight miles downstream of Gladstone. The Animas River Stakeholders Group (ARSG), U.S. Bureau of Land Management (BLM), DRMS and private stakeholders have completed remediation projects at the Evelyne, Henrietta, Joe and John, and Lark mines.

The Gold King Mine is the focus of this sampling effort. The site location is shown on Figure 1. Mine discharges and waste rock piles are the sources of waste at the Gold King Mine. Contaminants are released via oxidation of pyrite within the mine and mine waste pile. Natural dissolution of metal contaminants also occurs in this mineral-rich watershed. Water that flows through the mine and the mine waste pile carries the contaminants to downstream locations via surface water. Water discharged from the site flows to North Fork Cement Creek, Cement Creek and then to the Animas River, a fishery. Metals generated at the site that are transported via surface water may be attenuated along the flow paths to Cement Creek and the Animas River. There are several additional mines in the area that are also sources of metals to Cement Creek.

Contaminants include low pH and metals. From 2009 to 2011, cadmium concentrations from the mine discharge ranged from 38 micrograms per liter ($\mu\text{g/L}$) to 136 $\mu\text{g/L}$, copper concentrations ranged from 2400 $\mu\text{g/L}$ to 12,000 $\mu\text{g/L}$, lead concentrations ranged from 2 $\mu\text{g/L}$ to 29 $\mu\text{g/L}$, and zinc concentrations ranged from 14,500 $\mu\text{g/L}$ to 44,700 $\mu\text{g/L}$.

This mine entry is being performed to open up the mine, stabilize the portal, and investigate the near-portal segments of the adit, if practical.

Background Reference: URS Operating Services, Inc. 2010. Red and Bonita Mine Remedial Action Field Sampling Plan. October 2010.

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Worksheet 11 — Project/Data Quality Objectives

(UFP-QAPP Manual Section 2.6.1)

(EPA 2106-G-05 Section 2.2.6)

1. State the Problem

An EPA ERRS contractor will open the Gold King Mine, stabilize the portal, and potentially investigate the near-portal workings during September 2014 to allow additional investigation during subsequent years. Due to the high particulates present in mine discharges during entries of nearby mines, water will be captured, treated, then released downstream of the site.

EPA has requested that WESTON assist in developing and monitoring a water treatment system to increase the pH of adit discharge water and separate solids from the water prior to discharge from the site.

2. Identify the Goals of the Study

The goals of the study are to:

- Minimize discharges of particulates discharged from the Gold King Mine during the mine entry.

The primary study questions are:

- What quantities of sodium hydroxide and flocculant are required to minimize particulate discharges from the Gold King Mine site during the mine entry?
- Were contaminants released from the site in excess of the amount that would have been discharged if the mine entry did not occur?

3. Identify Information Inputs

To support the above objectives, the following data will be collected:

- Mine water will be collected in advance of the August mine entry and titrated to estimate the caustic addition rate needed to minimize solids discharges.
- Treatment system influent and effluent and downstream waters will be visually monitored to document the efficiency of the treatment system. Field analysis may include pH, conductivity, temperature, dissolved oxygen, turbidity, and total suspended solids. The information will be used by EPA to confirm that the mine entry did not cause a significant increase in contaminant loading relative to normal discharges from the Gold King Mine.

4. Define the Boundaries of the Study

Spatial Boundaries: The study area includes the Gold King Mine site (Figure 1), including the mine adit and water that flows from the site to Cement Creek.

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Temporal Boundaries: The study will represent conditions immediately before, during, and immediately after the 2014 mine entry that is scheduled for September 8-12, 2014. A sampling schedule and sampling plan is included in Worksheets 14, 16 and 17.

Practical constraints on data collection: Scheduling adjustments will be made if physical constraints on planned field events occur due to weather, safety considerations, or problems that may impact the technical quality of the measurements.

5. Develop the Analytic Approach

A mine water sample will be used to estimate the amount of sodium hydroxide (NaOH) required to treat mine discharges to a pH of 6 to 7 during the mine entry. One sample is considered adequate because the data will only be used to estimate the amount of NaOH needed for procurement purposes. The actual amount of NaOH added during field water treatment will be adjusted based on field pH measurements of treated water. On-site testing will be performed to determine the optimum flocculant addition rate using Brennfloc, the flocculant supplied by EPA.

Field parameters will be measured periodically in water discharged from the site toward North Fork Cement Creek. It is not anticipated that water quality monitoring data will be directly compared to specific action levels or regulatory limits such as Colorado water quality standards (WQS) because the data is being collected to document the presence or absence of particulates in discharged water. If the OSC directs that samples be collected from site discharge water, Cement Creek, or the Animas River, the results may be compared to WQS for Animas River Stream Segment 3b (Animas River) or 7 (Cement Creek).

6. Specify Performance or Acceptance Criteria

Observations of the packer test will be performed to ensure there is not excessive water draining from the borehole, pressures are maintained for at least 3 minutes at each pressure, and that 90% recovery occurs during the recovery test.

Total and dissolved metals concentrations in the sampled waters are expected to be high relative to the method detection limits, so standard laboratory reporting limits are considered adequate for the purposes of this data. All data will be reviewed and verified to ensure that they are acceptable for the intended use. Data will be validated at the request of the OSC.

Decision errors will be limited to the extent practicable by following approved U.S. EPA methods and applicable SOPs listed in Worksheet #21 and Appendix B. Any deviation from the SAP will be documented.

7. Develop the Detailed Plan for Obtaining Data

Water quality data will be obtained using a Horriba water quality meter at the pond and/or filter discharge location. Field monitoring will be used to measure the quality of water discharged from the treatment system, with emphasis on pH measurements.

If an uncontrolled release of contaminated water and sediment occurs as indicated by the presence of orange stained precipitates in water leaving the site, water between the treatment system and the discharge to Cement Creek and/or other downstream locations may be sampled at the discretion of the OSC. If samples are collected, data from the laboratories will be delivered in an electronic data deliverable and reported in the Site Activities Report.

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Worksheet 17 – Sample Design and Rationale, presents the sampling design, and QAPP Worksheets 19, 20, 24-28, and 30 specify analysis design requirements.

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Worksheet 14 & 16 —Project Tasks & Schedule
 (UFP-QAPP Manual Section 2.8.2)
 (EPA 2106-G-05 Section 2.2.4)

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Develop a Draft SAP and the EPA Region 8 QA Document Review Crosswalk	WESTON	July 31, 2014	September 5, 2014	Draft SAP and the Draft EPA Region 8 QA Document Review Crosswalk	September 5, 2014
Address EPA comments on Draft SAP and the Draft EPA Region 8 QA Document Review Crosswalk	WESTON	Upon receipt from EPA	1 week after receipt from EPA	SAP and the Final EPA Region 8 QA Document Review Crosswalk	1 week after receipt from EPA
Develop HASP	WESTON	August 2, 2014	August 8, 2014	HASP	August 8, 2014
Site work/Field Sampling	WESTON	August 26, 2014	September 30, 2014	NA	NA
Analytical Tasks*	ESAT	September 30, 2014	November 30, 2014	Laboratory Reports	To Weston TL: November 30, 2014 To EPA: with SAR
Quality Control Tasks*	WESTON	November 30, 2014	December 8, 2014	Report of Analyses/Data Package	To Weston TL: December 8, 2014 To EPA: with SAR
Draft Site Activities Report	WESTON	October 15, 2014	December 15, 2014	Draft Site Activities Report	December 15, 2014 If laboratory analysis is performed, the draft report will be provided on November 20, 2014
Address EPA comments on Draft Report	WESTON	December 19, 2014	December 31, 2014	Final Site Activities Report	December 31, 2014 or 2 weeks after EPA comments are received.

* If analysis is performed at the request of the OSC

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Worksheet 15 — Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

(UFP-QAPP Manual Sections 2.6.2.3 and Figure 15)

(EPA 2106-G-05 Section 2.2.6)

The following information will be provided for each matrix, analyte, analytical method, and concentration level (if applicable).

Matrix: Water

Analytical Method: 200.7, 200.8

Concentration level (if applicable): Low to High

Analyte	PAL ¹	PAL Reference ¹	PQL Goal	Laboratory Quantitation Limit ²	Laboratory Detection Limit ²
NaOH titration	NA	NA	0.05 mL/L	0.05 mL/L	0.05 mL/L
TAL Metals – Total and Dissolved	NA	NA	CRQL	CRQL	CRQL

¹ Links to State regulatory cleanup standards are provided in QAPP Appendix D.

² Terminology is project/laboratory-specific.

mL/L milliliters per liter

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Worksheet 17 — Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

(EPA 2106-G-05 Section 2.3.1)

An initial mine water sample will be collected upstream of the flume by dipping a container directly into the water, covering, and sending to START for a titration to estimate the sodium hydroxide addition rate needed to raise the pH of mine discharge water to 6 to 7 standard units. The initial pH of the water is expected to be between 2 and 4 standard units. Only one sample is needed because the titration will be used to estimate NaOH requirements; any uncertainty caused by collecting only one sample or from the inability to collect a sample from within the mine will be mitigated by the flexibility in the discharge pH (the range from 6 to 7 standard units) and the ability to adjust the NaOH addition rate during the water treatment process.

Treatment system discharges will be monitored for pH during operation of the treatment system, and other water quality parameters such as conductivity, TDS, and dissolved oxygen will be measured for as long as the additional information is helpful in determining whether the water treatment system is operating as intended. The target pH will be 6 to 7 standard units. Initially, properties will be measured at least every 15 minutes and reviewed hourly to confirm that the water treatment system is operating as intended. The discharge will be observed for the visible presence of solid precipitates at least hourly. The timing of measurements may be adjusted, as directed by the OSC, if conditions require more frequent measurements or if less frequent measurements are appropriate.

While it is not expected at this time, EPA may direct START to collect samples to characterize water quality impacts from site activities. Water samples for total metals analysis will be placed in a 1 liter (L) poly bottle and preserved with nitric acid to $\text{pH} \leq 2$. Water samples for dissolved metals analysis will be filtered with a $0.45 \mu\text{m}$ filter into a 1 L poly bottle and preserved with nitric acid to $\text{pH} \leq 2$. Samples will be placed in an iced cooler.

Sample descriptions and monitoring data will be logged in the instrument and/or the field logbook. DRMS will provide physical descriptions and photographs, where practical, for test and sample locations within the mine, including distance from portal and other pertinent information.

Samples collected from outside the mine for total and dissolved metals analysis will be labeled RBSW##mmddyyyy-T and RBSW##mmddyyyy-D, where ## is the two digit sample number, with the first sample number being 01, and -T and -D indicate whether the sample is for total or dissolved metals analysis. Samples collected from inside the mine will be labeled RBMW##mmddyyyy-T and RBMW##mmddyyyy-D.

Sampling and analytical activities performed on site will follow all applicable SOPs outlined in Worksheet 21, including EPA ERT SOP 2001 "General Field Sampling Guidelines". Sampling is anticipated to be performed in Level D personal protective equipment (PPE).

If collected, samples will be analyzed for the parameters listed in Table 2. In addition, requirements for the sample container, volume, preservation, and QC samples are presented in Table 2: Sampling and Analysis Summary.

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Worksheet 18 — Sampling Locations and Methods

(UFP-QAPP Manual Section 3.1.1 and 3.1.2)

(EPA 2106-G-05 Sections 2.3.1 and 2.3.2)

Sampling Location / ID	Matrix	Depth (units)	Type	Analyte/Analytical Group	Sampling SOP Reference ¹	Comments
Pre-mobilization mine water OR Post-treatment samples at discharge from water treatment system and discharge to Cement Creek, if requested by EPA	Water	NA	Grab	Total and Dissolved Metals	2013	Grab sample collected by dipping container in water.
Pre-mobilization mine water sample	Water	NA	Grab	Titration	2013	Titration with 25% or 50% NaOH

¹ Sampling SOPs references will be provided in Worksheet 21.

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Worksheet 20 — Field Quality Control Sample Summary

(UFP-QAPP Manual Sections 3.1.1 and 3.1.2.)

(EPA 2106-G-05 Section 2.3.5)

Matrix	Analyte/Analytical Group	No. of Field Samples ¹	No. of Field Duplicates	No. of MS/MSD ²	No. of Field Blanks	No. of Equip. Blanks	No. of Trip Blanks	No. of Other	Total No. of Samples to Laboratory
Water	Total Metals	0	1/10	0	0	0	0	0	0
Water	Dissolved Metals	0	1/10	0	0	0	0	0	0
Water	Titration	1	0	0	0	0	0	0	0

¹ Samples that are collected at different depths at the same location, and analyzed separately, will be counted as separate field samples. Even if they are taken from the same container as the parent field sample, MS/MSDs are counted separately, because they are analyzed separately. If composite samples or incremental samples are collected, only the sample that will be analyzed will be included; subsamples and increments will not be listed separately.

² Total number of samples to the laboratory does not include MS/MSD samples.

Note: If EPA requests that field samples be collected and analyzed for total and dissolved metals, the need for a duplicate will be determined based on the rationale for sampling. The number and types of QC samples will be based on project-specific DQOs and this worksheet will be adapted, as necessary, to accommodate project-specific requirements. Project-specific QC samples may include field duplicate, field blank, equipment blank, trip blank, field split, MS/MSD, and PT samples and will be collected in accordance with the frequencies recorded on QAPP Worksheet 12.

Quality Assurance Assessment and Corrective Actions are found in QAPP Worksheet #28.

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Worksheet 21 — Field SOPs
(UFP-QAPP Manual Section 3.1.2)
(EPA 2106-G-05 Section 2.3.2)

SOP Number or Reference	Title, Revision, Date, and URL (if available)	Originating Organization	SOP Option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
2006	Sampling Equipment Decontamination, 6/2011	U.S. EPA, ERT	NA	N	SOPs are available in Appendix B
2013	Surface Water Sampling, 6/2011	U.S. EPA, ERT	NA	N	SOPs are available in Appendix B
G-12	Specifications and Guidance for Contaminant-Free Sample Containers, 12/1992	U.S. EPA, Office of Solid Waste and Emergency Response	NA	N	SOPs are available in Appendix B
2001	General Field Sampling Guidelines, 6/2011	U.S. EPA, ERT	NA	N	SOPs are available in Appendix B

For purposes of this SAP, investigation-derived wastes (IDW) are defined as any byproduct of the field activities that is suspected or known to be contaminated with hazardous substances. The performance of field activities will produce waste products, including spent sampling supplies (disposable scoops) and expendable PPE. IDW will also include soil cuttings and decontamination fluids.

IDW will be managed in accordance with EPA Guide to Management of Investigation Derived Wastes (EPA 1992). Spent sampling supplies and expendable PPE are not anticipated to be considered a hazardous and will be containerized and disposed of in the municipal waste system. Soil cuttings will be returned to the boring or spread around the boring as soon as possible after generation and sampling is complete. Decontamination water will be poured onto the ground close to the boring from which the soil was collected.

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Worksheet 22 — Field Equipment Calibration, Maintenance, Testing, and Inspection
(UFP-QAPP Manual Section 3.1.2.4)
(EPA 2106-G-05 Section 2.3.6)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title or Position of Responsible Person	Verification	SOP Reference ¹
GPS	Calibrate tape against calibrated steel measuring tape	Clean prior and after each use, check battery	Calibration and operational equipment check	Visually inspect for obvious defects, broken parts, or cleanliness	Prior to use	Equipment operational	Repair/replace as needed	Field personnel	WAM/COR	Instrument-Specific
Horiba U-50/YSI® 600XLM Water Quality Meters	Calibrate probes with standards per instrument instruction manual	Check batteries, clean probes, store in manufacturer recommended solution	Calibration check	Visually inspect for external damage to probe(s)	Refer to instrument SOP	Refer to instrument SOP	Refer to instrument SOP	Field personnel	WAM/COR	G-13/G-14

¹ Refer to Field SOPs (Worksheet 21) and Analytical SOPs (Worksheet 23).

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Worksheet 23 — Analytical SOPs

(UFP-QAPP Manual Section 3.2.1)

(EPA 2106-G-05 Section 2.3.4)

Lab SOP Number ¹	Title, Revision Date, and/or Number and URL (if available)	Screening or Definitive Data	Matrix/Analytical Group	SOP Option or Equipment Type	Modified for Project? (Y/N)
TBD	METHOD 200.7 DETERMINATION OF METALS AND TRACE ELEMENTS IN WATER AND WASTES BY INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROMETRY (ICP-AES), Revision 4.4, EMMC Version. 1994. http://water.epa.gov/scitech/methods/cwa/bioindicators/upload/2007_07_10_methods_method_200_7.pdf	Definitive	Water	ICP-AES	TBD
TBD	METHOD 200.8 INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETRY (ICP-MS), Revision 5.4, EMMC Version.1994. http://water.epa.gov/scitech/methods/cwa/bioindicators/upload/2007_07_10_methods_method_200_8.pdf	Definitive	Water	ICP-MS	TBD

¹ Lab SOP numbers are lab-specific.

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Worksheet 24 — Analytical Instrument Calibration

(UFP-QAPP Manual Section 3.2.2)

(EPA 2106-G-05 Section 2.3.6)

As stated in Worksheet 22, START field personnel are responsible for the calibration of START and sub-contractor provided analytical field equipment. Documented and approved procedures will be used for calibrating measuring and testing equipment. Widely accepted procedures, such as those published by U.S. EPA and American National Standards Institute (ANSI), or procedures provided by manufacturers in equipment manuals will be adopted.

The responsibility for the calibration of laboratory equipment rests with the selected laboratories. Each type of instrumentation and each U.S. EPA-approved method have specific requirements for the calibration procedures, depending on the analytes of interest and the sample medium. The calibration procedures and frequencies of the equipment used to perform the analyses will be in accordance with requirements established by the U.S. EPA. The laboratory QA manager will be responsible for ensuring that the laboratory instrumentation is maintained in accordance with specifications. Individual laboratory SOPs will be followed for corrective actions and preventative maintenance frequencies. Laboratory quality control, calibration procedures, corrective action procedures, and instrument preventative maintenance will be included in an addendum to this QAPP once the laboratories have been selected for each sites. Items may include, but are not limited to those identified in the table below.

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Worksheet 24 — Analytical Instrument Calibration (Continued)

(UFP-QAPP Manual Section 3.2.2)

(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference ¹
ICP-AES	See 200.7	Calibration and initial calibration verification after instrument set up, then daily; continuing calibration verifications. Upper range within 10%. New upper range limits should be determined whenever a significant change in instrument response or every six months. Low-level continuing calibration verification (LLCCV) standard with 30%.	Initial and continuing calibration verification within $\pm 10\%$ of upper range true values and $\pm 30\%$ LLCCV true values.	Inspect system; correct problem; re-run calibration and affected samples	Lab Manager/Analyst	200.7
ICP/ ICP-MS	200.8	Calibration and initial calibration verification after instrument set up, then daily; continuing calibration verification 10% or every 2 hours, whichever is more frequent	Calibration $r^2 > 0.995$; initial and continuing calibration verification within $\pm 20\%$ of true values	Inspect system; correct problem; re-run calibration and affected samples	Lab Manager/Analyst	200.8

¹ Refer to the Analytical SOPs table (Worksheet 23).

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Worksheet 26 & 27 — Sample Handling, Custody, and Disposal

(UFP-QAPP Manual Section 3.3)

(EPA 2106-G-05 Manual Section 2.3.3)

Examples of field form (QAPP Appendix F), chain-of-custody (QAPP Appendix G), and sample label and custody seal (QAPP Appendix H) documentation are attached. SOPs for sample handling (identified in the table below) are located in QAPP Appendix I.

Sampling Organization: WESTON

Laboratory (Titration): Accutest, 4036 Youngfield Street, Wheat Ridge, CO 80033, Shea G, 303-425-6021, 303-425-6854

Laboratory (Total and dissolved metals): EPA Region 8 Laboratory, ESAT, 16194 West 45th Drive, Golden, CO 80033, Don Goodrich, Goodrich.donald@epa.gov, 303-312-6687; Mark McDaniel, mcdaniel.mark@epa.gov.

Note –The OSC will review and approve the SAP prior to proceeding with lab procurement. Therefore additional information will not be available until the lab procurement has been finalized.

Method of sample delivery (shipper/carrier): Hand delivered or FedEx

Number of days from reporting until sample disposal: 180

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference
Sample Labeling	WESTON Field Personnel	SOP G-1 & G-3
Chain-of-Custody Form Completion	WESTON Field Personnel	SOP G-8
Sample Packaging	WESTON Field Personnel	SOP G-9
Shipping Coordination	WESTON Field Personnel	SOP G-9
Sample Receipt, Inspection, & Log-in	Laboratory Sample Custodian	Laboratory SOP
Sample Custody and Storage	Laboratory Sample Custodian/Laboratory Analytical Personnel	Laboratory SOP
Sample Disposal	Field Personnel/Laboratory Sample Custodian /Laboratory Analytical Personnel	SOP G-1 & G-3/ Laboratory SOP

Supplies and consumables can be received at a WESTON office, U.S. EPA Warehouse or at a site. When supplies are received at a WESTON office or U.S. EPA Warehouse, the PM or PTL will sort the supplies according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before the supplies are accepted for use on a project. If the supplies do not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order. The item will then be returned to the vendor for replacement or repair.

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Worksheet 26 & 27 — Sample Handling, Custody, and Disposal (Continued)

(UFP-QAPP Manual Section 3.3)

(EPA 2106-G-05 Manual Section 2.3.3)

Procedures for receiving supplies and consumables in the field are similar to those described above. Upon receipt, items will be inspected by the WESTON PM or PTL against the acceptance criteria. Any deficiencies or problems will be noted in the field logbook, and deficient items will be returned for immediate replacement.

Laboratory Data Deliverables						
Record	VOCs	SVOCs	PCBs	Pesticides	Metals	Other
Narrative					X	
COC					X	
Summary Results					X	
QC Results					X	
Chromatograms						
Tentatively Identified Compounds						

Data collection activities, including sample collection and data generation, will be verified in accordance with the START IV Program QAPP, Worksheet #35.

Data will be validated by WESTON START.

Data will be reviewed for usability in accordance with the START IV Program QAPP, Worksheet #37.

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TABLES

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Table 1
SAP Revision Form

Site: Gold King Mine
OSC: Steven Way
TDD: 1306-07

Date	Revision Number	Proposed Change to SAP/QAPP	Reason for Change of Scope/Procedures	SAP Section Superseded	Requested By	Approved By

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Table 2
Sampling and Analysis Summary

Site: Gold King Mine
OSC: Steven Way
TDD: 1306-07

Matrix	Analytical Parameter	Analytical Method	Containers (Numbers, Size, and Type)	Preservation Requirements	Number of Sampling Locations	Number of Field Duplicates	Number of MS/MSDs ²	Number of Blanks (Trip, Field, Equip. Rinsate) ¹	Total Number of Samples to Lab ³	Holding Time
Water	Total Metals	200.7, 200.8	One 1-L poly bottle	Nitric acid to pH<2	0*	1 per 10	1 per 10	0	0	6 months
Water	Dissolved Metals	200.7, 200.8	One 1-L poly bottle	Filtered then preserved with nitric acid to pH≤2	0	1 per 10	1 per 10	0	0	6 months
Water	Titration	NA	1 1-L poly bottle	None	1	0	0	0	0	1 week

Notes:

¹ Trip blanks are only required for VOCs in water samples.

² For the samples designated for MS/MSDs, triple volume is required for VOCs and double volume for other water parameters.

³ Total number of samples to the laboratory does not include MS/MSD samples.

* Samples will be collected only if requested by the OSC.

°C – Degrees Celsius

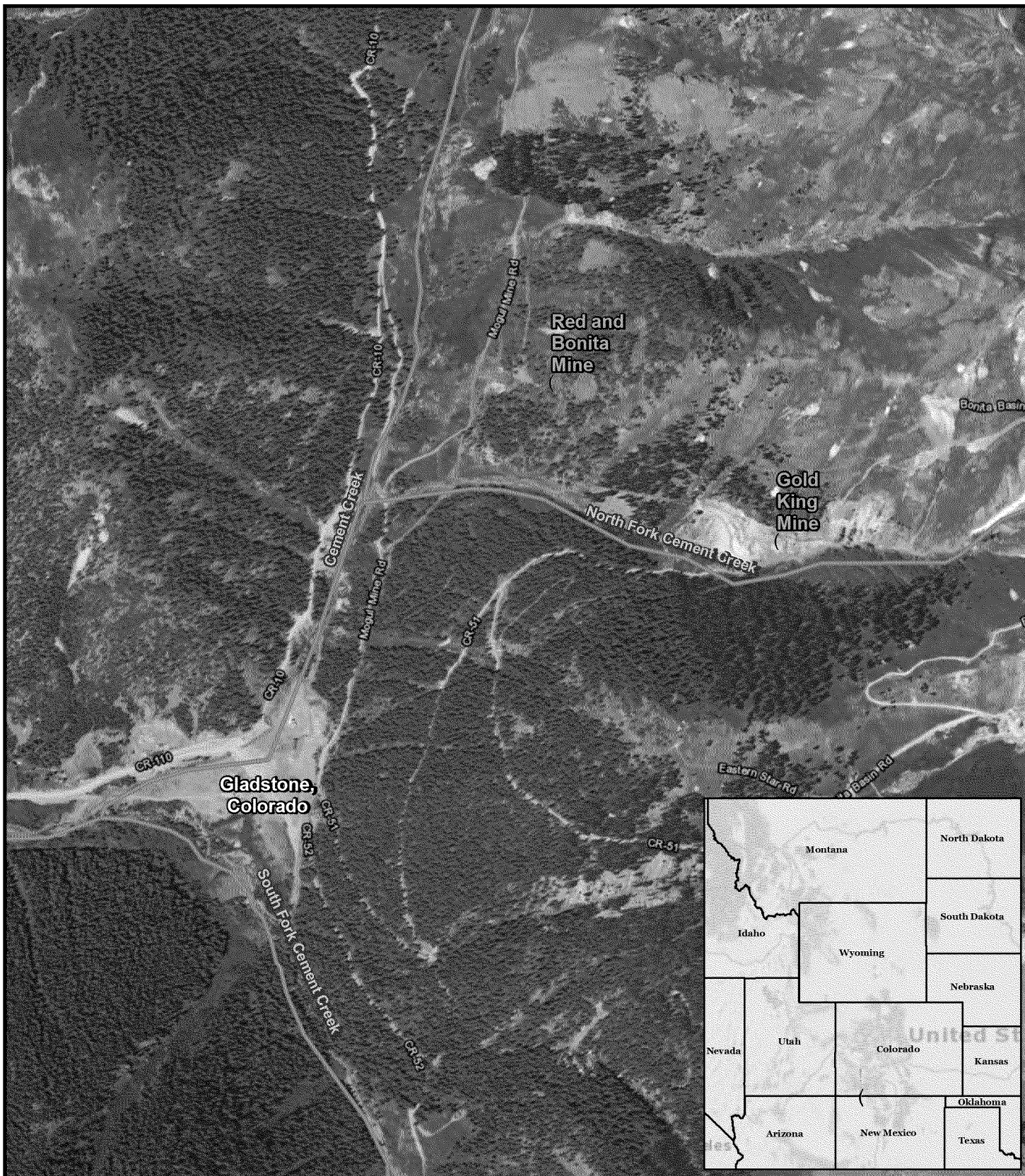
Equip. – Equipment

MS/MSD – Matrix Spike/Matrix Spike Duplicate

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FIGURES



<p>Legend</p> <p>! Mine Locations</p> <p>(Rivers and Streams</p> <p>0 0.075 0.15 0.3 Miles</p> <p></p>	<p>Prepared for: U.S. EPA Region 8</p> <p>Contract No.: EP-S8-13-01</p> <p>TDD: 1306-05 and 1408-01</p> <p>TO: 0001</p>	<p></p> <p>Prepared By: Weston Solutions, Inc. START IV</p> <p>Suite 100 1435 Garrison Street Lakewood, CO 80215</p>	<p>FIGURE 1 SITE VICINITY MAP GOLD KING MINE RED AND BONITA MINE SAN JUAN COUNTY, COLORADO</p> <p>Date: 9/5/2014</p>
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ATTACHMENTS

Appendix A
EPA Region 8 QA Document Review Crosswalk

EPA REGION 8 QA DOCUMENT REVIEW CROSSWALK

QAPP/FSP/SAP for: <i>(check appropriate box)</i>	Entity <i>(grantee, contract, EPA AO, EPA Program, Other)</i>	Regulatory Authority	<u>40 CFR 31 for Grants</u> <u>48 CFR Part 46 for Contracts</u> <u>Interagency Agreement</u> <u>EPA Administrative Order</u> <u>EPA Program Funding</u> <u>EPA Program Regulation</u> <u>EPA CIO 2105</u>
<input type="checkbox"/> GRANTEE	EPA – Removal Program; START Contractor (Weston Solutions)	and/or Funding Mechanism	
<input checked="" type="checkbox"/> CONTRACTOR			
<input type="checkbox"/> EPA			
<input type="checkbox"/> Other			
Document Title <i>[Note: Title will be repeated in Header]</i>	Gold King Mine Sampling and Analysis Plan		
QAPP/FSP/SAP Preparer	Weston Solutions, Inc.		
Period of Performance <i>(of QAPP/FSP/SAP)</i>	1 year from date of EPA approval of Task Level QAPP	Date Submitted for Review	September 5, 2014
EPA Project Officer EPA Project Manager	Joyce Ackerman Steven Way	PO Phone # PM Phone #	303-312-6822 303-312-6723
QA Program Reviewer or Approving Official		Date of Review	

Documents to Review:

1. QAPP written by Grantee or EPA must also include for review:
Work Plan(WP) / Statement of Work (SOW) / Program Plan (PP) / Research Proposal (RP)
2. QAPP written by Contractor must also include for review:
 - a) Copy of signed QARF for Task Order
 - b) Copy of Task Order SOW
 - c) Made available hard or electronic copy of approved QMP
 - d) If QMP not approved, provide Contract SOW

3. For a Field Sampling Plan (FSP) or Sampling & Analyses Plan (SAP), the Project QAPP must also be provided.

OR

The FSP or SAP must be clearly identified as a stand-alone QA document and must contain all QAPP required elements (Project Management, Data Generation/Acquisition, Assessment and Oversight, and Data Validation and Usability).

Summary of Comments *(highlight significant concerns/issues):*

1. Comment #1
2. Comment #2
3. Comment #3
4. The EPA – Removal Program; START Contractor (Weston Solutions) must address the comments in the Summary of Comments, as well as those identified in the Comment section(s) that includes a “Response (date)” and Resolved (date)”.

Documents Submitted for QAPP Review:

1. QA Document(s) submitted for review:

QA Document	Document Date	Document Stand-alone	Document with QAPP
QAPP	07/31/13	Yes / No	
FSP		Yes / No	Yes / No
SAP	09/5/14	Yes / No	Yes / No
SOP(s)			Yes / No

2. WP/SOW/TO/PP/RP Date EP-S8-13-01

WP/SOW/TO/RP Performance Period 12/30/14

3. QA document consistent with the:

WP/SOW/PP for grants? Yes / No

SOW/TO for contracts? Yes / No

4. QARF signed by R8 QAM Yes / No / NA

Funding Mechanism IA / contract / grant / NA

Amount _____

Element	Acceptable Yes/No/NA	Page/ Section	Comments
A. Project Management			
A1. Title and Approval Sheet			
a. Contains project title	Y	Title Page and Introduction Worksheet 1 & 2	
b. Date and revision number line (for when needed)	Y	Title Page and Revision Log	
c. Indicates organizations name	Y	Title Page	
d. Date and signature line for organizations project manager	Y	Worksheets 1 & 2, 4, 7 & 8	
e. Date and signature line for organizations QA manager	Y		
f. Other date and signatures lines, as needed	Y	Worksheets 1 & 2, 4, 7 & 8	
A2. Table of Contents			
a. Lists QA Project Plan information sections	Y	Table of Contents, List of Appendices	
b. Document control information indicated	Y	Worksheet 1 & 2, Revision Log	
A3. Distribution List			
Includes all individuals who are to receive a copy of the QA Project Plan and identifies their organization	Y	Worksheet 3 & 5	
A4. Project/Task Organization			
a. Identifies key individuals involved in all major aspects of the project, including contractors	Y	Worksheet 3 & 5, 6, 4, 7, & 8	
b. Discusses their responsibilities	Y	Worksheet 4, 7 & 8, 6	
c. Project QA Manager position indicates independence from unit generating data	Y	Worksheet 3 & 5, 4, 7 & 8	
d. Identifies individual responsible for maintaining the official, approved QA Project Plan	Y	Worksheet 4, 7 & 8, Revision Log	
e. Organizational chart shows lines of authority and reporting responsibilities	Y	Worksheet 3 & 5	
A5. Problem Definition/Background			
a. States decision(s) to be made, actions to be taken, or outcomes expected from the information to be obtained	Y	Worksheet 11	
b. Clearly explains the reason (site background or historical context) for initiating this project	Y	Worksheet 10	
c. Identifies regulatory information, applicable criteria, action limits, etc. necessary to the project	Y	Worksheets 11, 15	
A6. Project/Task Description			

Gold King Mine Sampling and Analysis Plan

a. Summarizes work to be performed, for example, measurements to be made, data files to be obtained, etc., that support the projects goals	Y	Worksheets 11, 14 & 16	
b. Provides work schedule indicating critical project points, e.g., start and completion dates for activities such as sampling, analysis, data or file reviews, and assessments	Y		
c. Details geographical locations to be studied, including maps where possible	Y	Worksheets 10, 11	
d. Discusses resource and time constraints, if applicable	Y		
A7. Quality Objectives and Criteria			
a. Identifies - performance/measurement criteria for all information to be collected and acceptance criteria for information obtained from previous studies, - including project action limits and laboratory detection limits and - range of anticipated concentrations of each parameter of interest	Y	Worksheets 12.1 & 12.2	
b. Discusses precision	Y	Worksheets 12, 36, 37	
c. Addresses bias	Y		
d. Discusses representativeness	Y		
e. Identifies the need for completeness	Y		
f. Describes the need for comparability	Y		
g. Discusses desired method sensitivity	Y		
A8. Special Training/Certifications			
a. Identifies any project personnel specialized training or certifications	Y	Worksheet 4, 7 & 8	
b. Discusses how this training will be provided	Y		
c. Indicates personnel responsible for assuring training/certifications are satisfied	Y		
d. identifies where this information is documented	Y		
A9. Documentation and Records			
a. Identifies report format and summarizes all data report package information	Y	Worksheets 14 & 16, 29	Data reporting only. No report requested.
b. Lists all other project documents, records, and electronic files that will be produced	Y	Worksheet 14 & 16	

Gold King Mine Sampling and Analysis Plan

c. Identifies where project information should be kept and for how long	Y	Worksheet 29	
d. Discusses back up plans for records stored electronically	Y		
e. States how individuals identified in A3 will receive the most current copy of the approved QA Project Plan, identifying the individual responsible for this	Y	Worksheet 4, 7 & 8	
B. Data Generation/Acquisition			
B1. Sampling Process Design (Experimental Design)			
a. Describes and justifies design strategy, indicating size of the area, volume, or time period to be represented by a sample	Y	Worksheet 11, 17	
b. Details the type and total number of sample types/matrix or test runs/trials expected and needed	Y	Worksheets 17, 18	Unknown number of samples
c. Indicates where samples should be taken, how sites will be identified/located	Y		
d. Discusses what to do if sampling sites become inaccessible	Y	Worksheet 17	
e. Identifies project activity schedules such as each sampling event, times samples should be sent to the laboratory, etc.	Y	Worksheets 14 & 16	Schedules may change due to the nature of emergency response.
f. Specifies what information is critical and what is for informational purposes only	Y	Worksheet 17	
g. Identifies sources of variability and how this variability should be reconciled with project information	Y	Worksheet 17	
B2. Sampling Methods			
a. Identifies all sampling SOPs by number, date, and regulatory citation, indicating sampling options or modifications to be taken	Y	Worksheet 21	
b. Indicates how each sample/matrix type should be collected	Y	Worksheet 19 & 30	
c. If in situ monitoring, indicates how instruments should be deployed and operated to avoid contamination and ensure maintenance of proper data	Y	Worksheet 22	
d. If continuous monitoring, indicates averaging time and how instruments should store and maintain raw data, or data averages	NA	Worksheet 22	

Gold King Mine Sampling and Analysis Plan

e. Indicates how samples are to be homogenized, composited, split, or filtered, if needed	Y	Worksheet 21	If needed
f. Indicates what sample containers and sample volumes should be used	Y	Worksheet 19 & 30	
g. Identifies whether samples should be preserved and indicates methods that should be followed	Y		
h. Indicates whether sampling equipment and samplers should be cleaned and/or decontaminated, identifying how this should be done and by-products disposed of	Y	Worksheet 21	If needed
i. Identifies any equipment and support facilities needed	Y	Worksheet 22	
j. Addresses actions to be taken when problems occur, identifying individual(s) responsible for corrective action and how this should be documented	Y	Worksheets 17, 31, 32 & 33	
B3. Sample Handling and Custody			
a. States maximum holding times allowed from sample collection to extraction and/or analysis for each sample type and, for in-situ or continuous monitoring, the maximum time before retrieval of information	Y	Worksheet 19 & 30	
b. Identifies how samples or information should be physically handled, transported, and then received and held in the laboratory or office (including temperature upon receipt)	Y	Worksheet 26 & 27	
c. Indicates how sample or information handling and custody information should be documented, such as in field notebooks and forms, identifying individual responsible	Y		
d. Discusses system for identifying samples, for example, numbering system, sample tags and labels, and attaches forms to the plan	Y		
e. Identifies chain-of-custody procedures and includes form to track custody	Y		
B4. Analytical Methods			
a. Identifies all analytical SOPs (field, laboratory and/or office) that should be followed by number, date, and regulatory citation, indicating options or modifications to be taken, such as sub-sampling and extraction procedures	Y	Worksheet 23	
b. Identifies equipment or instrumentation needed	Y	Worksheets 23, 24	
c. Specifies any specific method performance criteria	Y	Worksheet 24	

Gold King Mine Sampling and Analysis Plan

d. Identifies procedures to follow when failures occur, identifying individual responsible for corrective action and appropriate documentation	Y		
e. Identifies sample disposal procedures	Y	Worksheet 26 & 27	
f. Specifies laboratory turnaround times needed	Y	Worksheet 19 & 30	
g. Provides method validation information and SOPs for nonstandard methods	Y	Worksheets 23, 36	
B5. Quality Control			
a. For each type of sampling, analysis, or measurement technique, identifies QC activities which should be used, for example, blanks, spikes, duplicates, etc., and at what frequency	Y	Worksheet 20	
b. Details what should be done when control limits are exceeded, and how effectiveness of control actions will be determined and documented	Y	Worksheet 28 - Identifies general criteria. Actual inputs determined on a project-specific basis	
c. Identifies procedures and formulas for calculating applicable QC statistics, for example, for precision, bias, outliers and missing data	Y	Worksheet 37	
B6. Instrument/Equipment Testing, Inspection, and Maintenance			
a. Identifies field and laboratory equipment needing periodic maintenance, and the schedule for this	Y	Worksheets 22, 24	
b. Identifies testing criteria	Y		
c. Notes availability and location of spare parts	Y		
d. Indicates procedures in place for inspecting equipment before usage	Y	Worksheets 22, 24	
e. Identifies individual(s) responsible for testing, inspection and maintenance	Y		
f. Indicates how deficiencies found should be resolved, re-inspections performed, and effectiveness of corrective action determined and documented	Y	Worksheets 22, 24	
B7. Instrument/Equipment Calibration and Frequency			
a. Identifies equipment, tools, and instruments that should be calibrated and the frequency for this calibration	Y	Worksheet 25	
b. Describes how calibrations should be performed and documented, indicating test criteria and standards or certified equipment	Y	Worksheet 25	

Gold King Mine Sampling and Analysis Plan

c. Identifies how deficiencies should be resolved and documented	Y		
B8. Inspection/Acceptance for Supplies and Consumables			
a. Identifies critical supplies and consumables for field and laboratory, noting supply source, acceptance criteria, and procedures for tracking, storing and retrieving these materials	Y	Worksheet 26 & 27	
b. Identifies the individual(s) responsible for this	Y		
B9. Use of Existing Data (Non-direct Measurements)			
a. Identifies data sources, for example, computer databases or literature files, or models that should be accessed and used	Y	Worksheet 13	
b. Describes the intended use of this information and the rationale for their selection, i.e., its relevance to project	Y		
c. Indicates the acceptance criteria for these data sources and/or models	Y		
d. Identifies key resources/support facilities needed	Y		
e. Describes how limits to validity and operating conditions should be determined, for example, internal checks of the program and Beta testing	Y		
B10. Data Management			
a. Describes data management scheme from field to final use and storage	Y	Worksheets 11, 26 & 27, 29, 35	
b. Discusses standard record-keeping and tracking practices, and the document control system or cites other written documentation such as SOPs	Y	Worksheets 26 & 27, 29	
c. Identifies data handling equipment/procedures that should be used to process, compile, analyze, and transmit data reliably and accurately	Y	Worksheets 22, 23, 29	
d. Identifies individual(s) responsible for this	Y	Worksheet 29	
e. Describes the process for data archival and retrieval	Y		
f. Describes procedures to demonstrate acceptability of hardware and software configurations	Y	Worksheets 22, 23	
g. Attaches checklists and forms that should be used	Y		
C. Assessment and Oversight			
C1. Assessments and Response Actions			

Gold King Mine Sampling and Analysis Plan

a. Lists the number, frequency, and type of assessment activities that should be conducted, with the approximate dates	Y	Worksheet 31, 32 & 33	
b. Identifies individual(s) responsible for conducting assessments, indicating their authority to issue stop work orders, and any other possible participants in the assessment process	Y		
c. Describes how and to whom assessment information should be reported	Y		
d. Identifies how corrective actions should be addressed and by whom, and how they should be verified and documented	Y		
C2. Reports to Management			
a. Identifies what project QA status reports are needed and how frequently	Y	Worksheet 31, 32 & 33	
b. Identifies who should write these reports and who should receive this information	Y		
D. Data Validation and Usability			
D1. Data Review, Verification, and Validation			
Describes criteria that should be used for accepting, rejecting, or qualifying project data	Y	Worksheet 36	
D2. Verification and Validation Methods			
a. Describes process for data verification and validation, providing SOPs and indicating what data validation software should be used, if any	Y	Worksheets 34, 35, 36	
b. Identifies who is responsible for verifying and validating different components of the project data/information, for example, chain-of-custody forms, receipt logs, calibration information, etc.	Y	Worksheet 35	
c. Identifies issue resolution process, and method and individual responsible for conveying these results to data users	Y	Worksheets 35, 36	
d. Attaches checklists, forms, and calculations	Y	Worksheet 34	
D3. Reconciliation with User Requirements			
a. Describes procedures to evaluate the uncertainty of the validated data	Y	Worksheets 11, 12, 35, 36	
b. Describes how limitations on data use should be reported to the data users	Y	Worksheet 36	

Appendix B Selected Standard Operating Procedures



SURFACE WATER SAMPLING

SOP#: 2013
DATE: 11/17/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) is applicable to the collection of representative liquid samples, both aqueous and non-aqueous from streams, rivers, lakes, ponds, lagoons, and surface impoundments. It includes samples collected from depth, as well as samples collected from the surface.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure or other procedure limitations. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Sampling situations vary widely, therefore, no universal sampling procedure can be recommended. However, sampling of both aqueous and non-aqueous liquids from the above mentioned sources is generally accomplished through the use of one of the following samplers or techniques:

- C Kemmerer bottle
- C Bacon bomb sampler
- C Dip sampler
- C Direct method

These sampling techniques will allow for the collection of representative samples from the majority of surface waters and impoundments encountered.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Once samples have been collected, the following procedure should be followed:

1. Transfer the sample(s) into suitable, labeled sample containers.
2. Preserve the sample if appropriate, or use pre-preserved sample bottles. Do not overfill bottles if they are pre-preserved.
3. Cap the container, place in a ziploc plastic bag and cool to 4°C.
4. Record all pertinent data in the site logbook and on field data sheets.
5. Complete the Chain of Custody record.
6. Attach custody seals to cooler prior to shipment.
7. Decontaminate all sampling equipment prior to the collection of additional samples with that sampling device.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary interferences or potential problems with surface water sampling. These include cross contamination of samples and improper sample collection.

1. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Refer to the Sampling Equipment Decontamination SOP.
2. Improper sample collection can involve using contaminated equipment, disturbance of the stream or impoundment substrate, and sampling in an obviously disturbed area.

Following proper decontamination procedures and minimizing disturbance of the sample site will eliminate these problems.

5.0 EQUIPMENT/APPARATUS

Equipment needed for collection of surface water samples may include (depending on technique chosen):

- C Kemmerer bottles
- C Bacon bomb sampler
- C Dip sampler
- C Line and messengers
- C Sample bottles/preservatives
- C Ziploc bags
- C Ice
- C Coolers
- C Chain of Custody records, custody seals
- C Field data sheets
- C Decontamination equipment
- C Maps/plot plan
- C Safety equipment
- C Compass
- C Tape measure
- C Survey stakes, flags, or buoys and anchors
- C Camera and film
- C Logbook/waterproof pen
- C Sample bottle labels

6.0 REAGENTS

Reagents will be utilized for preservation of samples and for decontamination of sampling equipment. The preservatives required are specified by the analysis to be performed.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.
2. Obtain the necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.
5. Perform a general site survey prior to site entry, in accordance with the site specific Health and Safety Plan.
6. Use stakes, flagging, or buoys to identify and mark all sampling locations. If required the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. If collecting sediment samples, this procedure may disturb the bottom.

7.2 Representative Sampling Considerations

In order to collect a representative sample, the hydrology and morphometrics of a stream or impoundment should be determined prior to sampling. This will aid in determining the presence of phases or layers in lagoons, or impoundments, flow patterns in streams, and appropriate sample locations and depths.

Water quality data should be collected in impoundments, and to determine if stratification is present. Measurements of dissolved oxygen, pH, and temperature can indicate if strata exist which would effect analytical results. Measurements should be collected at one-meter intervals from the substrate to the surface using the appropriate instrument (i.e., a Hydrolab or equivalent).

Water quality measurements such as dissolved oxygen, pH, temperature, conductivity, and oxidation-reduction potential can assist in the interpretation of analytical data and the selection of sampling sites and depths when surface water samples are collected.

Generally, the deciding factors in the selection of a sampling device for sampling liquids in streams, rivers, lakes, ponds, lagoons, and surface impoundments are:

1. Will the sample be collected from shore or from a boat?
2. What is the desired depth at which you wish to collect the sample?
3. What is the overall depth and flow direction of river or stream?
4. What type of sample will be collected (i.e., water or lagoon liquids)?

7.2.1 Sampler Composition

The appropriate sampling device must be of a proper composition. Selection of samplers constructed of glass, stainless steel, PVC or PFTE (Teflon) should be based upon the analyses to be performed.

7.3 Sample Collection

7.3.1 Kemmerer Bottle

A Kemmerer bottle (Figure 1, Appendix A) may be used in most situations where site access is from a boat or structure such as a bridge or pier, and where samples at depth are required. Sampling procedures are as follows:

1. Use a properly decontaminated Kemmerer bottle. Set the sampling device so that the sampling end pieces (upper and lower stoppers) are pulled away from the sampling tube (body), allowing the substance to be sampled to pass through this tube.
2. Lower the pre-set sampling device to the predetermined depth. Avoid bottom disturbance.

3. When the Kemmerer bottle is at the required depth, send down the messenger, closing the sampling device.
4. Retrieve the sampler and discharge from the bottom drain the first 10-20 mL to clear any potential contamination of the valve. Transfer the sample to the appropriate sample container.

7.3.2 Bacon Bomb Sampler

A bacon bomb sampler (Figure 2, Appendix A) may be used in situations similar to those outlined for the Kemmerer bottle. Sampling procedures are as follows:

1. Lower the bacon bomb sampler carefully to the desired depth, allowing the line for the trigger to remain slack at all times. When the desired depth is reached, pull the trigger line until taut. This will allow the sampler to fill.
2. Release the trigger line and retrieve the sampler.
3. Transfer the sample to the appropriate sample container by pulling up on the trigger.

7.3.3 Dip Sampler

A dip sampler (Figure 3, Appendix A) is useful in situations where a sample is to be recovered from an outfall pipe or along a lagoon bank where direct access is limited. The long handle on such a device allows access from a discrete location. Sampling procedures are as follows:

1. Assemble the device in accordance with the manufacturer's instructions.
2. Extend the device to the sample location and collect the sample by dipping the sampler into the substance.
3. Retrieve the sampler and transfer the sample to the appropriate sample container.

7.3.4 Direct Method

For streams, rivers, lakes, and other surface waters, the direct method may be utilized to collect water samples from the surface directly into the sample bottle. This method is not to be used for sampling lagoons or other impoundments where contact with contaminants is a concern.

Using adequate protective clothing, access the sampling station by appropriate means. For shallow stream stations, collect the sample under the water surface while pointing the sample container upstream; the container must be upstream of the collector. Avoid disturbing the substrate. For lakes and other impoundments, collect the sample under the water surface avoiding surface debris and the boat wake.

When using the direct method, do not use pre-preserved sample bottles as the collection method may dilute the concentration of preservative necessary for proper sample preservation.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following general QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures.

More specifically, when sampling lagoons or surface impoundments containing known or suspected hazardous substances, adequate precautions must be taken to ensure the safety of sampling personnel. The sampling team member collecting the sample should not get too close to the edge of the impoundment, where bank failure may cause him/her to lose his/her balance. The person performing the sampling should be on a lifeline and be wearing adequate protective equipment. When conducting sampling from a boat in an impoundment or flowing waters, appropriate boating safety procedures should be followed.

12.0 REFERENCES

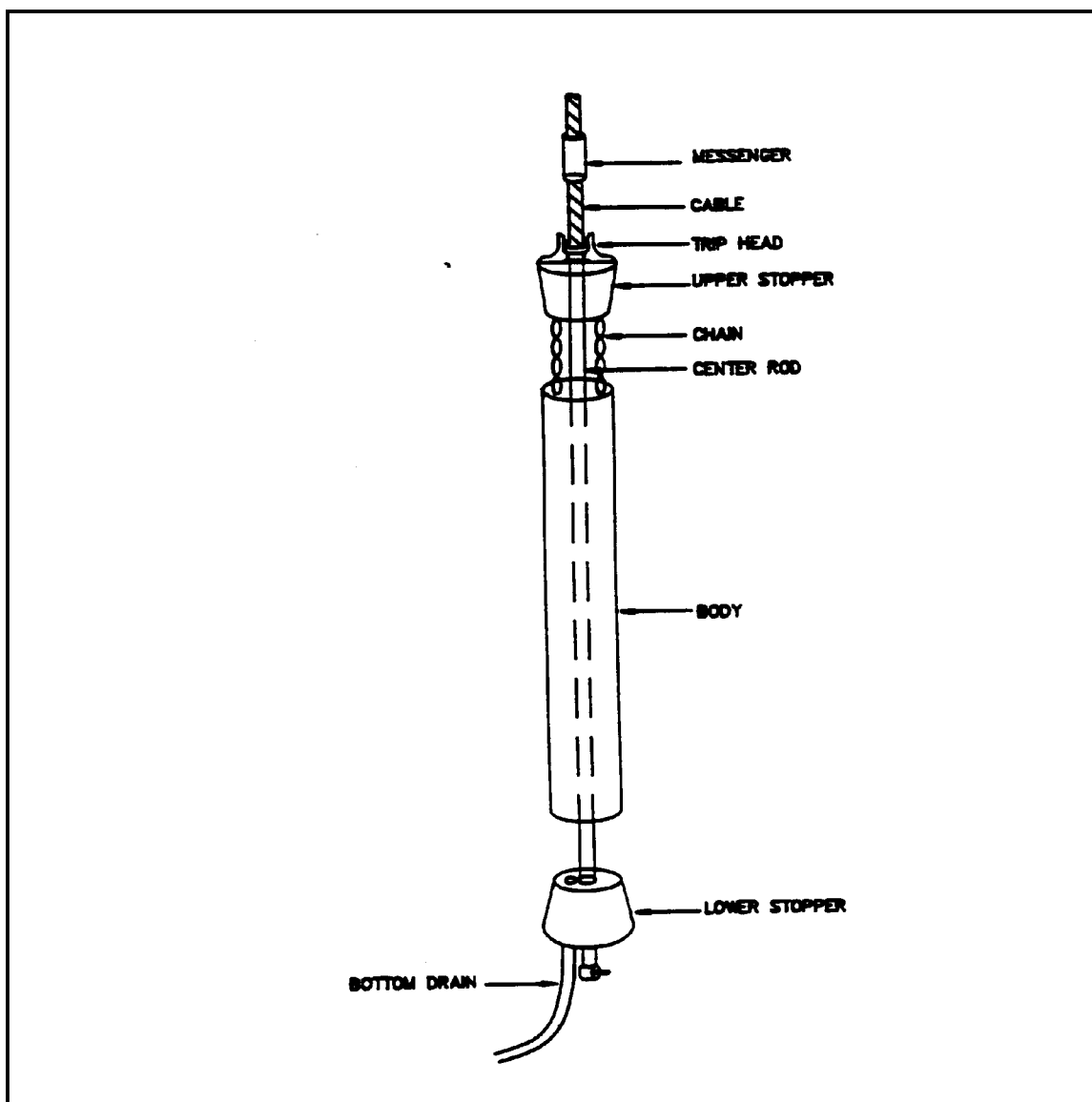
U.S. Geological Survey. 1977. National Handbook or Recommended Methods for Water Data Acquisition. Office of Water Data Coordination Reston, Virginia. (Chapter Updates available).

U.S. Environmental Protection Agency. 1984. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA/600/4-84-076.

APPENDIX A

Figures

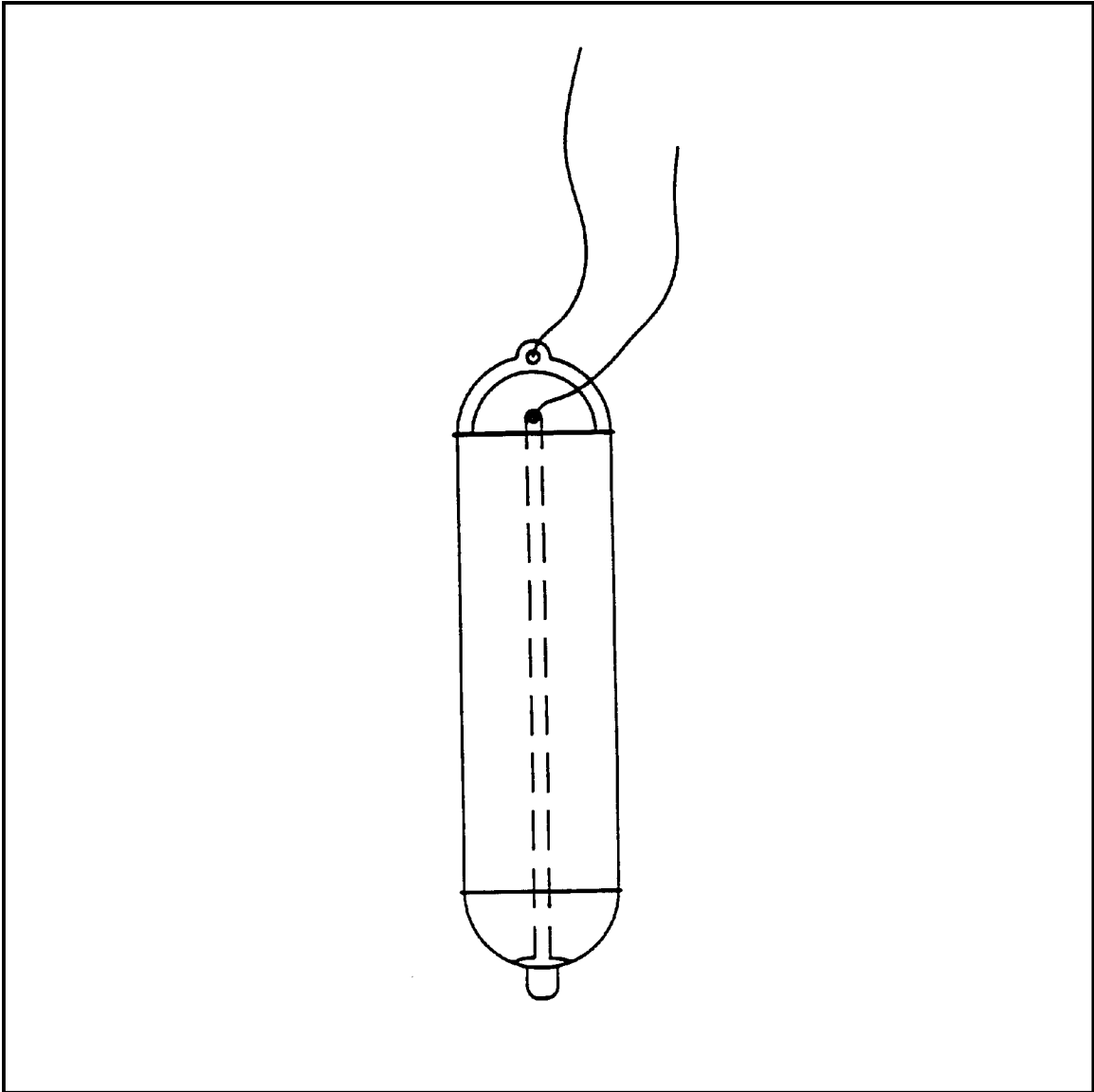
FIGURE 1. Kemmerer Bottle



APPENDIX A (Cont'd)

Figures

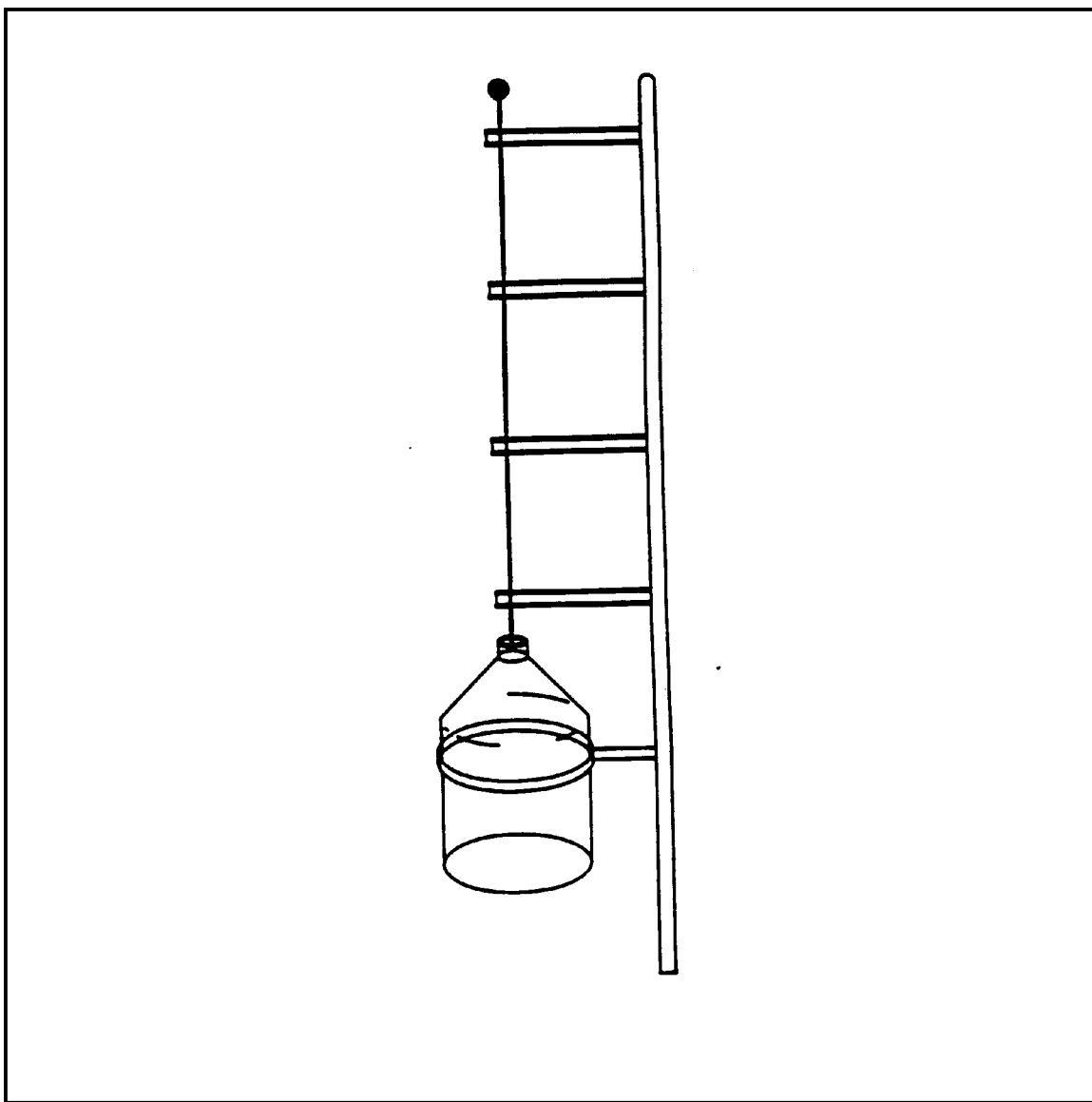
FIGURE 2. Bacon Bomb Sampler



APPENDIX A (Cont'd)

Figures

FIGURE 3. Dip Sampler





SAMPLING EQUIPMENT DECONTAMINATION

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1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure

water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern at a given site or if Target Compound List analysis (which includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure described above may be summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

If a particular contaminant fraction is not present at the site, the nine (9) step decontamination procedure specified above may be modified for site specificity. For example, the nitric acid rinse may be eliminated if metals are not of concern at a site. Similarly, the solvent rinse may be eliminated if organics are not of

concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest.

More specifically, sample collection and analysis of decontamination waste may be required before beginning proper disposal of decontamination liquids and solids generated at a site. This should be determined prior to initiation of site activities.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

- C The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).
- C The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.
- C If acids or solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.
- C Damage can be incurred by acid and solvent washing of complex and sophisticated sampling equipment.

5.0 EQUIPMENT/APPARATUS

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-

bristle scrub brushes or long-handled bottle brushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

5.1 Decontamination Solutions

- C Non-phosphate detergent
- C Selected solvents (acetone, hexane, nitric acid, etc.)
- C Tap water
- C Distilled or deionized water

5.2 Decontamination Tools/Supplies

- C Long and short handled brushes
- C Bottle brushes
- C Drop cloth/plastic sheeting
- C Paper towels
- C Plastic or galvanized tubs or buckets
- C Pressurized sprayers (H₂O)
- C Solvent sprayers
- C Aluminum foil

5.3 Health and Safety Equipment

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash)

5.4 Waste Disposal

- C Trash bags
- C Trash containers
- C 55-gallon drums
- C Metal/plastic buckets/containers for storage and disposal of decontamination solutions

6.0 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions. Table 1 (Appendix A) lists solvent rinses which may be required for elimination of particular chemicals. In

general, the following solvents are typically utilized for decontamination purposes:

- C 10% nitric acid is typically used for inorganic compounds such as metals. An acid rinse may not be required if inorganics are not a contaminant of concern.
- C Acetone (pesticide grade)⁽¹⁾
- C Hexane (pesticide grade)⁽¹⁾
- C Methanol⁽¹⁾

⁽¹⁾ - Only if sample is to be analyzed for organics.

7.0 PROCEDURES

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The decontamination line should be set up before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- C The number, location, and layout of decontamination stations.
- C Decontamination equipment needed.
- C Appropriate decontamination methods.
- C Methods for disposal of contaminated clothing, equipment, and solutions.
- C Procedures can be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (3) covering monitoring and sampling equipment with plastic, aluminum foil, or other protective material; (4) watering down dusty areas; (5) avoiding laying down equipment in areas of obvious contamination; and (6) use of disposable sampling equipment.

7.1 Decontamination Methods

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Various decontamination methods will remove contaminants by: (1) flushing or other physical action, or (2) chemical complexing to inactivate

contaminants by neutralization, chemical reaction, disinfection, or sterilization.

Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning methods are most commonly used at hazardous waste sites. The following abrasive methods are available:

Mechanical

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, time of application, and angle at which the abrasive strikes the surface will dictate cleaning efficiency. Disadvantages of this method are the inability to control the amount of material removed and the large amount of waste generated.

Wet Blasting

Wet blast cleaning involves use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using a very fine abrasive, the amount of materials removed can be carefully controlled.

7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

Ultra-High-Pressure Water

This system produces a water jet that is pressured from 1,000 to 4,000 atmospheres. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 meters/second (m/s) (1,000 atm) to 900 m/s (4,000 atm). Additives can be used to enhance the cleaning action.

Rinsing

Contaminants are removed by rinsing through dilution, physical attraction, and solubilization.

Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment. This method of decontamination is typically performed off-site.

7.2 Field Sampling Equipment Decontamination Procedures

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. The spread of contaminants is further reduced by separating each decontamination station by a minimum of three (3) feet. Ideally, the contamination should decrease as the equipment progresses from one station to another farther along in the line.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC) which is in the CRZ. Figure 1 (Appendix B) shows a typical contaminant reduction zone layout. The CRC controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The CRC boundaries should be conspicuously marked. The far end is the hotline, the boundary between the exclusion zone and the contamination reduction zone. The size of the decontamination corridor depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site. Whenever possible, it should be a straight line.

Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Another corridor may be required for the entry and exit of heavy equipment. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRC. Personnel don their equipment away from the CRC and enter the exclusion zone through a separate access control point at the hotline. One person (or more) dedicated to decontaminating equipment is recommended.

7.2.1 Decontamination Setup

Starting with the most contaminated station, the decontamination setup should be as follows:

Station 1: Segregate Equipment Drop

Place plastic sheeting on the ground (Figure 2, Appendix B). Size will depend on amount of

equipment to be decontaminated. Provide containers lined with plastic if equipment is to be segregated. Segregation may be required if sensitive equipment or mildly contaminated equipment is used at the same time as equipment which is likely to be heavily contaminated.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

As indicated in 7.1.2, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity.

A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.

Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station. Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 4: Water Basin

Fill a wash basin, a large bucket, or child's swimming

pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10-50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 5: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process. Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 6: Nitric Acid Sprayers

Fill a spray bottle with 10% nitric acid. An acid rinse may not be required if inorganics are not a contaminant of concern. The amount of acid will depend on the amount of equipment to be decontaminated. Provide a 5-gallon bucket or basin to collect acid during the rinsing process.

Station 7: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 8: Organic Solvent Sprayers

Fill a spray bottle with an organic solvent. After each solvent rinse, the equipment should be rinsed with distilled/deionized water and air dried. Amount of solvent will depend on the amount of equipment to decontaminate. Provide a 5-gallon bucket or basin to collect the solvent during the rinsing process.

Solvent rinses may not be required unless organics are a contaminant of concern, and may be eliminated from the station sequence.

Station 9: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 10: Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom

plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty. Provide aluminum foil, plastic, or other protective material to wrap clean equipment.

7.2.2 Decontamination Procedures

Station 1: Segregate Equipment Drop

Deposit equipment used on-site (i.e., tools, sampling devices and containers, monitoring instruments radios, clipboards, etc.) on the plastic drop cloth/sheet or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination. Loose leaf sampling data sheets or maps can be placed in plastic zip lock bags if contamination is evident.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

Use high pressure wash on grossly contaminated equipment. Do not use high- pressure wash on sensitive or non-waterproof equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Scrub equipment with soap and water using bottle and bristle brushes. Only sensitive equipment (i.e., radios, air monitoring and sampling equipment) which is waterproof should be washed. Equipment which is not waterproof should have plastic bags removed and wiped down with a damp cloth. Acids and organic rinses may also ruin sensitive equipment. Consult the manufacturers for recommended decontamination solutions.

Station 4: Equipment Rinse

Wash soap off of equipment with water by immersing the equipment in the water while brushing. Repeat as many times as necessary.

Station 5: Low-Pressure Rinse

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 6: Nitric Acid Sprayers (required only if metals are a contaminant of concern)

Using a spray bottle rinse sampling equipment with nitric acid. Begin spraying (inside and outside) at one end of the equipment allowing the acid to drip to the other end into a 5-gallon bucket. A rinsate blank may be required at this station. Refer to Section 9.

Station 7: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 8: Organic Solvent Sprayers

Rinse sampling equipment with a solvent. Begin spraying (inside and outside) at one end of the equipment allowing the solvent to drip to the other end into a 5-gallon bucket. Allow the solvent to evaporate from the equipment before going to the next station. A QC rinsate sample may be required at this station.

Station 9: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure washer.

Station 10: Clean Equipment Drop

Lay clean equipment on plastic sheeting. Once air dried, wrap sampling equipment with aluminum foil, plastic, or other protective material.

7.2.3 Post Decontamination Procedures

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.
2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
3. Empty soap and water liquid wastes from basins and buckets and store in appropriate

drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

4. Empty acid rinse waste and place in appropriate container or neutralize with a base and place in appropriate drum. pH paper or an equivalent pH test is required for neutralization. Consult DOT requirements for appropriate drum for acid rinse waste.
5. Empty solvent rinse sprayer and solvent waste into an appropriate container. Consult DOT requirements for appropriate drum for solvent rinse waste.
6. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.
7. Empty low-pressure sprayer water onto the ground.
8. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
9. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

A rinsate blank is one specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field.

Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling

equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is not utilized, collect one rinsate blank per day per type of sampling device samples to meet QA2 and QA3 objectives.

If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

10.0 DATA VALIDATION

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Decontamination can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before use. Decontamination materials may degrade protective clothing or equipment; some solvents can permeate protective clothing. If decontamination materials do pose a health hazard, measures should be taken to protect personnel or substitutions should be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination

equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e., acetone, alcohol, and trisodiumphosphate).

In some jurisdictions, phosphate containing detergents (i.e., TSP) are banned.

12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, February, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February, 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October, 1985.

APPENDIX A

Table

Table 1. Soluble Contaminants and Recommended Solvent Rinse

TABLE 1 Soluble Contaminants and Recommended Solvent Rinse		
SOLVENT ⁽¹⁾	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Tap water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazines)
Dilute Bases	Sodium bicarbonate (e.g., soap detergent)	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents ⁽²⁾	Alcohols Ethers Ketones Aromatics Straight chain alkalines (e.g., hexane) Common petroleum products (e.g., fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent ⁽²⁾	Hexane	PCBs

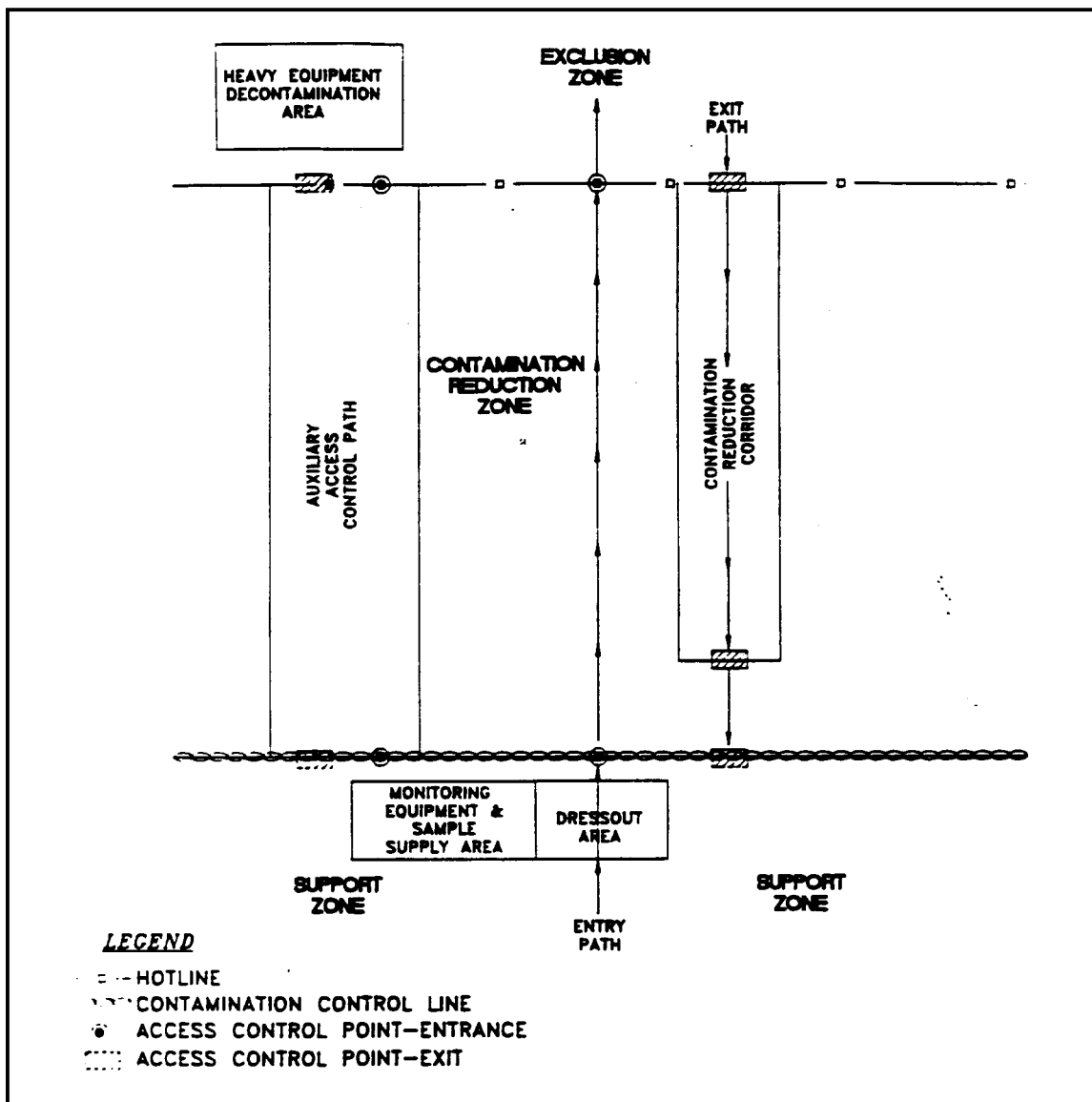
⁽¹⁾ - Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

⁽²⁾ - WARNING: Some organic solvents can permeate and/or degrade the protective clothing

APPENDIX B

Figures

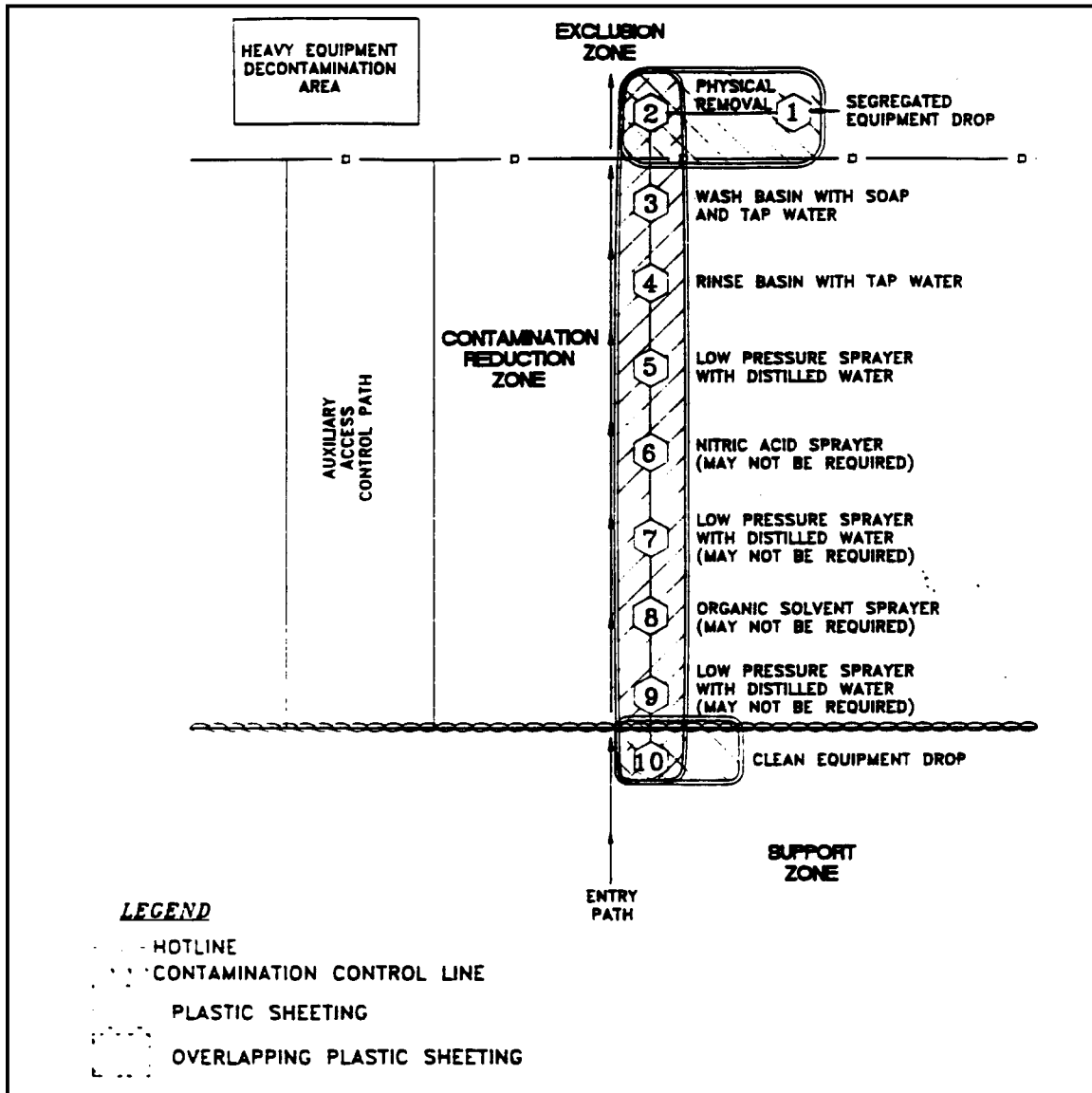
Figure 1. Contamination Reduction Zone Layout



APPENDIX B (Cont'd.)

Figures

Figure 2. Decontamination Layout





GENERAL FIELD SAMPLING GUIDELINES

SOP#: 2001
DATE: 08/11/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide general field sampling guidelines that will assist REAC personnel in choosing sampling strategies, location, and frequency for proper assessment of site characteristics. This SOP is applicable to all field activities that involve sampling.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Sampling is the selection of a representative portion of a larger population, universe, or body. Through examination of a sample, the characteristics of the larger body from which the sample was drawn can be inferred. In this manner, sampling can be a valuable tool for determining the presence, type, and extent of contamination by hazardous substances in the environment.

The primary objective of all sampling activities is to characterize a hazardous waste site accurately so that its impact on human health and the environment can be properly evaluated. It is only through sampling and analysis that site hazards can be measured and the job of cleanup and restoration can be accomplished effectively with minimal risk. The sampling itself must be conducted so that every sample collected retains its original physical form and chemical composition. In this way, sample integrity is insured, quality assurance standards are maintained, and the sample can accurately represent the larger body of

material under investigation.

The extent to which valid inferences can be drawn from a sample depends on the degree to which the sampling effort conforms to the project's objectives. For example, as few as one sample may produce adequate, technically valid data to address the project's objectives. Meeting the project's objectives requires thorough planning of sampling activities, and implementation of the most appropriate sampling and analytical procedures. These issues will be discussed in this procedure.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected, and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest. Sample preservation, containers, handling, and storage for air and waste samples are discussed in the specific SOPs for air and waste sampling techniques.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The nature of the object or materials being sampled may be a potential problem to the sampler. If a material is homogeneous, it will generally have a uniform composition throughout. In this case, any sample increment can be considered representative of the material. On the other hand, heterogeneous samples present problems to the sampler because of changes in the material over distance, both laterally and vertically.

Samples of hazardous materials may pose a safety threat to both field and laboratory personnel. Proper health and safety precautions should be implemented when handling this type of sample.

Environmental conditions, weather conditions, or non-target chemicals may cause problems and/or interferences when performing sampling activities or when sampling for a specific parameter. Refer to the specific SOPs for sampling techniques.

5.0 EQUIPMENT/APPARATUS

The equipment/apparatus required to collect samples must be determined on a site specific basis. Due to the wide variety of sampling equipment available, refer to the specific SOPs for sampling techniques which include lists of the equipment/apparatus required for sampling.

6.0 REAGENTS

Reagents may be utilized for preservation of samples and for decontamination of sampling equipment. The preservatives required are specified by the analysis to be performed. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

7.0 PROCEDURE

7.1 Types of Samples

In relation to the media to be sampled, two basic types of samples can be considered: the environmental sample and the hazardous sample.

Environmental samples are those collected from streams, ponds, lakes, wells, and are off-site samples that are not expected to be contaminated with hazardous materials. They usually do not require the special handling procedures typically used for concentrated wastes. However, in certain instances, environmental samples can contain elevated concentrations of pollutants and in such cases would have to be handled as hazardous samples.

Hazardous or concentrated samples are those collected from drums, tanks, lagoons, pits, waste piles, fresh spills, or areas previously identified as contaminated, and require special handling procedures because of their potential toxicity or hazard. These samples can be further subdivided based on their degree of hazard; however, care should be taken when handling and shipping any wastes believed to be concentrated regardless of the degree.

The importance of making the distinction between environmental and hazardous samples is two-fold:

- (1) Personnel safety requirements: Any sample thought to contain enough hazardous materials to pose a safety threat should be designated as hazardous and handled in a manner which ensures the safety of both field and laboratory personnel.
- (2) Transportation requirements: Hazardous samples must be packaged, labeled, and shipped according to the International Air Transport Association (IATA) Dangerous Goods Regulations or Department of Transportation (DOT) regulations and U.S. EPA guidelines.

7.2 Sample Collection Techniques

In general, two basic types of sample collection techniques are recognized, both of which can be used for either environmental or hazardous samples.

Grab Samples

A grab sample is defined as a discrete aliquot representative of a specific location at a given point in time. The sample is collected all at once at one particular point in the sample medium. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples will decrease.

Composite Samples

Composites are nondiscrete samples composed of more than one specific aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can in certain instances be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask problems by diluting isolated concentrations of some hazardous compounds below detection limits.

Compositing is often used for environmental samples and may be used for hazardous samples under certain conditions. For example, compositing of hazardous waste is often performed after compatibility tests have

been completed to determine an average value over a number of different locations (group of drums). This procedure generates data that can be useful by providing an average concentration within a number of units, can serve to keep analytical costs down, and can provide information useful to transporters and waste disposal operations.

For sampling situations involving hazardous wastes, grab sampling techniques are generally preferred because grab sampling minimizes the amount of time sampling personnel must be in contact with the wastes, reduces risks associated with compositing unknowns, and eliminates chemical changes that might occur due to compositing.

7.3 Types of Sampling Strategies

The number of samples that should be collected and analyzed depends on the objective of the investigation. There are three basic sampling strategies: random, systematic, and judgmental sampling.

Random sampling involves collection of samples in a nonsystematic fashion from the entire site or a specific portion of a site. Systematic sampling involves collection of samples based on a grid or a pattern which has been previously established. When judgmental sampling is performed, samples are collected only from the portion(s) of the site most likely to be contaminated. Often, a combination of these strategies is the best approach depending on the type of the suspected/known contamination, the uniformity and size of the site, the level/type of information desired, etc.

7.4 QA Work Plans (QAWP)

A QAWP is required when it becomes evident that a field investigation is necessary. It should be initiated in conjunction with, or immediately following, notification of the field investigation. This plan should be clear and concise and should detail the following basic components, with regard to sampling activities:

- C Objective and purpose of the investigation.
- C Basis upon which data will be evaluated.
- C Information known about the site including location, type and size of the facility, and length of operations/abandonment.
- C Type and volume of contaminated material, contaminants of concern (including

concentration), and basis of the information/data.

- C Technical approach including media/matrix to be sampled, sampling equipment to be used, sample equipment decontamination (if necessary), sampling design and rationale, and SOPs or description of the procedure to be implemented.
- C Project management and reporting, schedule, project organization and responsibilities, manpower and cost projections, and required deliverables.
- C QA objectives and protocols including tables summarizing field sampling and QA/QC analysis and objectives.

Note that this list of QAWP components is not all-inclusive and that additional elements may be added or altered depending on the specific requirements of the field investigation. It should also be recognized that although a detailed QAWP is quite important, it may be impractical in some instances. Emergency responses and accidental spills are prime examples of such instances where time might prohibit the development of site-specific QAWPs prior to field activities. In such cases, investigators would have to rely on general guidelines and personal judgment, and the sampling or response plans might simply be a strategy based on preliminary information and finalized on site. In any event, a plan of action should be developed, no matter how concise or informal, to aid investigators in maintaining a logical and consistent order to the implementation of their task.

7.5 Legal Implications

The data derived from sampling activities are often introduced as critical evidence during litigation of a hazardous waste site cleanup. Legal issues in which sampling data are important may include cleanup cost recovery, identification of pollution sources and responsible parties, and technical validation of remedial design methodologies. Because of the potential for involvement in legal actions, strict adherence to technical and administrative SOPs is essential during both the development and implementation of sampling activities.

Technically valid sampling begins with thorough planning and continues through the sample collection and analytical procedures. Administrative requirements involve thorough, accurate

documentation of all sampling activities. Documentation requirements include maintenance of a chain of custody, as well as accurate records of field activities and analytical instructions. Failure to observe these procedures fully and consistently may result in data that are questionable, invalid and non-defensible in court, and the consequent loss of enforcement proceedings.

8.0 CALCULATIONS

Refer to the specific SOPs for any calculations which are associated with sampling techniques.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

Refer to the specific SOPs for the type and frequency of QA/QC samples to be analyzed, the acceptance criteria for the QA/QC samples, and any other QA/QC activities which are associated with sampling techniques.

10.0 DATA VALIDATION

Refer to the specific SOPs for data validation activities that are associated with sampling techniques.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and corporate health and safety procedures.